Sustainable investing in times of crisis: evidence from bond holdings and the COVID-19 pandemic

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3rd JRC Summer School on Sustainable finance
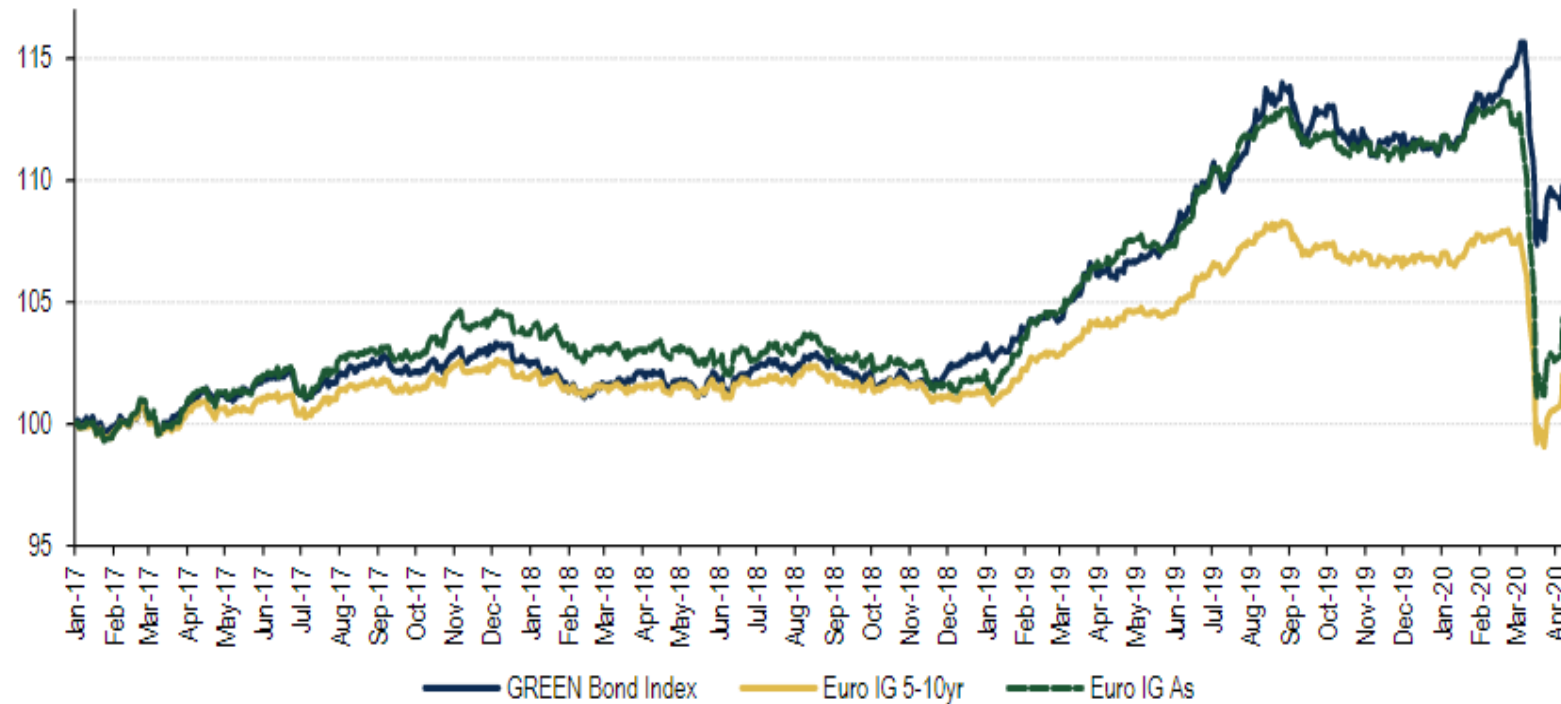
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Motivation

Chart 2: Total returns rebased to January 2017: the ICE BofA Green bond index has outperformed Euro Single As and Euro IG 5-10yr maturities

The ICE BofA Green bond index (GREN) is rated A1 compared to A3 for Euro Single As and Euro IG 5-10yr

— GREEN Bond Index   — Euro IG 5-10yr   --- Euro IG As

Source: BofA Global Research, ICE Data Indices, LLC, Bloomberg

'The ICE BofA Green Bond Index spent 2017 and 2018 performing almost exactly in line with equivalent euro investment-grade bonds. **In crisis conditions, however, green bonds have come into their own'** – Bloomberg

Motivation cont'd

- Ma et al. (2020) find a sharp drop of the greenium (= negative yield premium for GBs) in March 2020 almost at the moment the VIX spikes. Potential (untested) explanations:
  - GBs are proportionally more held in portfolios of investors focusing on non-pecuniary (environmental) aspects
  - GBs are part of more buy-and-hold long-term strategies and therefore hence less affected by market volatility

➔ What we do: explore the role of institutional investors (= demand side) in GB performance in crisis times

➔ COVID-19 as exogenous shock allows to draw indications on the resilience of GBs to market stress

Research questions and preview of the results

- Do GBs sell differently than conventional bonds?
  - Not in normal times,
  - … while in crisis times (=Covid outbreak) they are sold less

- Are there differences in selling behavior across institutional investors?
  - Mutual funds liquidate less of GBs during the Covid outbreak…
  - … insurers also during the Covid rebound quarter (2020-Q2)
  - Sustainability-oriented funds sell less GBs than their non-ESG peers

- Are bond ownership patterns different?
  - GB ownership is more concentrated than that of conventional bonds, and has increased during the Covid outbreak (for corporate GBs).

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Literature

Stock market reaction to COVID-19:
- Ramelli and Wagner (2021): financial channels amplify real shocks from the health crisis
- Capelle-Blancard and Desroziers (2020): loose link between stock market and fundamentals in the COVID period

CSR during crises:
- Lins et al. (2017): during the GFC stocks with high CSR intensity outperform those with low social capital
- Broadstock et al. (2020): ESG performance mitigates financial risk during financial crises
- Ding (2021): during the COVID pandemic, companies with more CSR activities experience milder drop in stock returns
- Albuquerque et al. (2020): during the COVID outbreak stocks with high ES ratings have higher and less volatile returns than low-ES firms

Institutional investors during crises:
- Manconi et al. (2010): institutional investors contributed to the transmissions of shocks in the bond market during the GFC
- Carvalho and Schmitz (2021): aggregate evidence on investment funds driving a broad-based rebalancing towards domestic sovereign debt during COVID-19

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Outline of the presentation

- Data

- Analysis of bond sales

- Analysis of bond ownership concentration

- Conclusion

Data

We use a rich dataset with matched information from different databases:

- **Refinitiv eMAXX**: fixed income positions of nearly 30k US, EU and international institutional investors. Our sample period: 2018-Q3 to 2020-Q2. Bond holdings are recorded in par amounts, that is nominal values, not in market values

- **Dealogic DCM:** data on worldwide bond issuances at tranche level

- **Bloomberg:** funds with ESG mandate (Bloomberg classification)
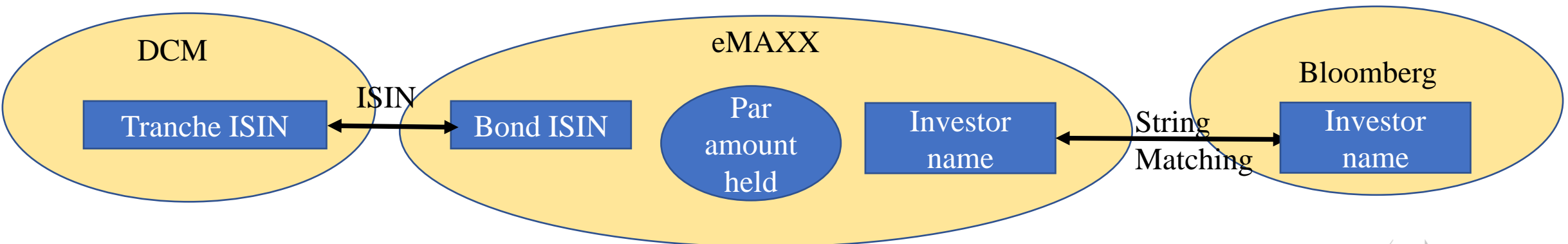
Data management and matching procedure

Securities selection

We filter bond ISINs for which EMAXX has a proprietary share greater than 25% of the issued amount at least in a quarter in order to reduce bias from bonds that are not reported consistently in eMAXX.

Matching

To minimize concerns of endogeneity, we apply a matching procedure:

- For each green bond, we select conventional bonds issued in the same industry and country

- We apply the propensity score matching algorithm to pick conventional bonds similar to the green bonds based on relevant characteristics (Yield at Issuance, years to maturity, rating, puttable and callable)

- The algorithm selects for each green bonds the three most similar conventional bonds or nearest neighbors (ratio 1:3)

Empirical strategy: sales regressions

$Log\ NetSales_{hijt}$

$$= a_0 + a_1 green\ bond_i + a_2 Covid + \boldsymbol{a_3} green\ bond_i \times Covid + \beta \text{Controls}_{hijt} + \mu_h + \mu_j + \varepsilon_{ihjt}.$$

Dependent variable: Log net sales of bond *i* issued by company h and held by investor j in quarter t

Green bond$_i$= dummy variable equal to one if security i is a green bond

Covid is a dummy for, alternatively:

- 2020-Q1 → outbreak period
- 2020-Q2 → rebound period

Bond controls :

- Bond outstanding amount = log (amount oustanding)
- Bond age= log(age)
- Dummies for callable, puttable, collateralized, rating category, currency, maturity category, downgraded

Investor controls :

- Bond holding by investor= log(amount of bond i held by investor j)
- Portfolio size= log(total portfolio amount of investor j)

Market controls: Stock market index and volatility

Fixed effects μ_h Issuer FE, μ_j Investor FE,

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Sales – baseline results

Panel A: Outbreak period (2020-Q1)	All bonds		Corporate bonds	
Green bond × *COVID*	-0.0705***	-0.0675***	-0.0807***	-0.0686***
	(0.022)	(0.022)	(0.023)	(0.023)
Green bond	-0.0260	-0.0237	-0.0256	
	(0.018)	(0.018)	(0.018)	
COVID	0.1070***	0.1939***		
	(0.019)	(0.049)		
Bond outstanding amount	0.0555***	0.0640***	0.0591***	0.8287***
	(0.019)	(0.022)	(0.022)	(0.105)
Bond age	-0.0130	-0.0125	-0.0091	-0.0262*
	(0.009)	(0.009)	(0.009)	(0.016)
Downgraded	0.0327***	0.0382***	0.0395***	0.0270***
	(0.011)	(0.011)	(0.011)	(0.010)
Bond holding by investor	0.0234***	0.0193**	0.0191**	-0.5933***
	(0.008)	(0.009)	(0.009)	(0.051)
Portfolio size	-0.0976***	-0.0967***	-0.0953***	-0.0461**
	(0.027)	(0.027)	(0.027)	(0.020)
Sectoral stock market volatility		-0.1285		
		(0.110)		
Sectoral stock market return		0.1384**		
		(0.058)		

Panel B Rebound period (2020-Q2)	All bonds		Corporate bonds	
Green bond × *COVID*	-0.0107	-0.0219	-0.0654***	-0.0729***
	(0.024)	(0.022)	(0.023)	(0.024)
Green bond	-0.0249	-0.0163	-0.0138	
	(0.017)	(0.017)	(0.017)	
COVID	-0.0046	0.0213		
	(0.014)	(0.051)		
Bond issue characteristics included	Yes	Yes	Yes	No
Fixed effects:				
Issuer	Yes	Yes	Yes	Yes
Investor	Yes	Yes	Yes	No
Issuer sector X country X time	No	No	Yes	Yes
Investor country X time	No	No	Yes	Yes
Bond X Investor	No	No	No	Yes
Number of investors	6196	6042	6042	5965
Observations	119,510	114,450	114,450	111,417
R-squared	0.3714	0.3681	0.3743	0.5835
Adjusted R-squared	0.336	0.332	0.336	0.453

Outbreak period

- GBs experience lower sales than conventional bonds during market turmoil
- No evidence that GBs sell differently w.r.t. conventional bonds in normal times
- Sales increase in 2020-Q1

Rebound period
- Corporate GBs sell less than conventional bonds during the rebound period
- No evidence of 'abnormal' selling behavior

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Sales by mutual funds

Panel A: Outbreak period (2020-Q1)	All bonds		Corporate bonds	
Green bond × *COVID*	-0.0942***	-0.0859**	-0.0763**	-0.0680**
	(0.033)	(0.034)	(0.033)	(0.034)
Green bond	-0.0042	0.0015	0.0003	
	(0.025)	(0.027)	(0.027)	
COVID	0.2638***	0.4081***		
	(0.032)	(0.073)		
Bond outstanding amount	0.1252***	0.1528***	0.1483***	0.8406***
	(0.024)	(0.027)	(0.027)	(0.156)
Bond age	-0.0361***	-0.0371***	-0.0344**	-0.0174
	(0.013)	(0.013)	(0.014)	(0.020)
Downgraded	0.0294*	0.0355**	0.0345**	0.0195
	(0.016)	(0.016)	(0.017)	(0.016)
Bond holding by investor	0.0400***	0.0366**	0.0373***	-0.5696***
	(0.013)	(0.014)	(0.014)	(0.057)
Portfolio size	-0.2694***	-0.2801***	-0.3015***	-0.1114
	(0.067)	(0.072)	(0.076)	(0.074)
Sectoral stock market volatility		-0.2117		
		(0.160)		
Sectoral stock market return		0.2052**		
		(0.086)		
Bond issue characteristics included	Yes	Yes	Yes	No
Fixed effects:				
Issuer	Yes	Yes	Yes	Yes
Investor	Yes	Yes	Yes	No
Issuer sector X country X time	No	No	Yes	Yes
Investor country X time	No	No	Yes	Yes
Bond X Investor	No	No	No	Yes
Number of investors	3523	3409	3409	3352
Observations	66,653	62,476	62,476	60,415
R-squared	0.3690	0.3651	0.3725	0.5814
Adjusted R-squared	0.331	0.326	0.331	0.439

Outbreak period:

In line with the baseline:
- GBs experience lower sales than conventional bonds (all and corporate) during market turmoil
- More sales than in 'normal times'

→ funds liquidate their positions as they are exposed to withdrawals by clients

Rebound period (not shown):
No significance difference in sales of GBs w.r.t conventionals

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Sales by insurers

Panel A: Outbreak period (2020-Q1)	All bonds		Corporate bonds	
Green bond × *COVID*	-0.1334***	-0.1328***	-0.1448***	-0.1408***
	(0.033)	(0.033)	(0.035)	(0.035)
Green bond	0.0263	0.0290	0.0251	
	(0.027)	(0.027)	(0.027)	
COVID	-0.0998***	-0.1300**		
	(0.014)	(0.063)		
Bond outstanding amount	-0.1085***	-0.1152***	-0.1259***	0.9676***
	(0.042)	(0.042)	(0.043)	(0.173)
Bond age	0.0076	0.0145	0.0151	-0.0439*
	(0.013)	(0.013)	(0.011)	(0.025)
Downgraded	0.0314**	0.0381***	0.0212	0.0135
	(0.014)	(0.014)	(0.015)	(0.014)
Bond holding by investor	-0.0133	-0.0143	-0.0135	-0.8836***
	(0.009)	(0.009)	(0.009)	(0.184)
Portfolio size	-0.0179	-0.0171	-0.0208	-0.0145
	(0.013)	(0.013)	(0.013)	(0.012)
Sectoral stock market volatility		0.2729*		
		(0.148)		
Sectoral stock market return		0.2935***		
		(0.084)		
Panel B Rebound period (2020-Q2)	**All bonds**		**Corporate bonds**	
Green bond × *COVID*	-0.1251***	-0.1209***	-0.1443***	-0.1412***
	(0.032)	(0.032)	(0.034)	(0.035)
Green bond	0.0318	0.0298	0.0298	
	(0.025)	(0.025)	(0.025)	
COVID	-0.1382***	-0.1580***		
	(0.014)	(0.058)		
Bond issue characteristics included	Yes	Yes	Yes	No
Fixed effects:				
Issuer	Yes	Yes	Yes	Yes
Investor	Yes	Yes	Yes	No
Issuer sector X country X time	No	No	Yes	Yes
Investor country X time	No	No	Yes	Yes
Bond X Investor	No	No	No	Yes
Number of investors	1842	1839	1839	1832
Observations	42,108	41,851	41,851	41,238
R-squared	0.3210	0.3218	0.3308	0.5579
Adjusted R-squared	0.287	0.288	0.296	0.435

Outbreak period:

- Sales of GBs decrease
- No evidence that GBs sell differently w.r.t. conventional bonds in normal times
- Sales decrease

Rebound period:
- No difference with the outbreak period

→ Unlike mutual funds, insurers do not feel pressure to sell.

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Sales: Bloomberg ESG funds

Panel A: Outbreak period (2020-Q1)	All bonds		Corporate bonds	
Green bond × COVID ×ESG mandate	-0.3407**	-0.3354**	-0.3974**	-0.4952***
	(0.153)	(0.153)	(0.164)	(0.183)
Green bond × ESG mandate	0.1224	0.1413	0.1547*	
	(0.084)	(0.087)	(0.090)	
COVID × ESG mandate	0.2649	0.2726	0.2703	0.3444*
	(0.179)	(0.181)	(0.183)	(0.184)
Green bond × *COVID*	-0.0866***	-0.0786**	-0.0659**	-0.0558
	(0.033)	(0.035)	(0.033)	(0.035)
Green bond	-0.0065	-0.0009	-0.0028	
	(0.026)	(0.027)	(0.027)	
COVID	0.2598***	0.4039***		
	(0.032)	(0.073)		
Bond outstanding amount	0.1256***	0.1533***	0.1489***	0.8395***
	(0.024)	(0.027)	(0.027)	(0.156)
Bond age	-0.0360***	-0.0370***	-0.0344**	-0.0171
	(0.013)	(0.013)	(0.014)	(0.020)
Downgraded	0.0400***	0.0365**	0.0372***	-0.5702***
	(0.013)	(0.014)	(0.014)	(0.057)
Bond holding by investor	0.0296*	0.0357**	0.0347**	0.0198
	(0.015)	(0.016)	(0.017)	(0.016)
Portfolio size	-0.2719***	-0.2823***	-0.3046***	-0.1139
	(0.066)	(0.072)	(0.076)	(0.074)
Bond issue characteristics included	Yes	Yes	Yes	No
Fixed effects:				
Issuer	Yes	Yes	Yes	Yes
Investor	Yes	Yes	Yes	No
Issuer sector X country X time	No	No	Yes	Yes
Investor country X time	No	No	Yes	Yes
Bond X Investor	No	No	No	Yes
Number of investors	3523	3410	3410	3352
Observations	66,653	62,476	62,476	60,415
R-squared	0.3691	0.3653	0.3726	0.5815
Adjusted R-squared	0.331	0.326	0.331	0.439

Outbreak period:

- ESG funds are selling less of GBs than non-ESG funds

Rebound period (not shown):

- No significant differences in sales of GBs by funds with ESG mandate w.r.t. no-ESG funds

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Robustness and extensions

- An alternative measure of sustainability (MSCI): Evidence that AAA-rated ESG investors sell less of GBs only for the corporate bond subsample

- Policy action to foster sustainable finance at the EU level: results are in line with baseline ones when we exclude from the sample EU investors and EU issuers

- Bond purchase programs during the COVID period: No evidence that GBs eligible for the FED Secondary Market Corporate Credit Facility (SMCCF) or the ECB Pandemic Emergency Purchase Program (PEPP) sell differently w.r.t non-eligible GBs during the outbreak period.

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Empirical strategy: bond ownership concentration

$$HHI_{it} = a_0 + a_1 green\ bond_i + a_2 Covid + \boldsymbol{a_3} green\ bond_i \times Covid + \beta \text{Controls}_{it} + \mu_h + \varepsilon_{ijt}.$$

Dependent variable: HHI$_{hit}$ Herfindahl-Hirschman index of concentration for bond i, with issuer h, in quarter t

Green bond$_i$= dummy variable equal to one if bond i is green

Covid is a dummy for, alternatively:

• 2020-Q1 → outbreak period

• 2020-Q2 → rebound period

Bond controls:

• Bond outstanding amount = log (amount oustanding)

• Bond age = log(age)

• Dummies for callable, puttable, collaterized, rating category, currency, maturity category, downgraded

Fixed effects: μ_h Issuer FE

HHI regressions

Panel A: Outbreak period (2020-Q1)	All bonds		Corporate bonds	
Green bond × *COVID*	0.0212	0.0305**	0.0300**	0.0383***
	(0.014)	(0.015)	(0.013)	(0.013)
Green bond	0.1416***	0.1053***	0.1073***	
	(0.021)	(0.020)	(0.021)	
COVID	-0.0033	0.0168		
	(0.006)	(0.028)		
Bond outstanding amount	-0.0822***	-0.1002***	-0.1000***	0.0777*
	(0.011)	(0.014)	(0.015)	(0.045)
Bond age	-0.0070	-0.0105*	-0.0134*	0.0006
	(0.005)	(0.005)	(0.007)	(0.006)
Downgraded	-0.0172*	-0.0042	-0.0059	-0.0058
	(0.009)	(0.006)	(0.007)	(0.004)
Sectoral stock market volatility		-0.0512		
		(0.067)		
Sectoral stock market return		-0.0149		
		(0.021)		

Panel B Rebound period (2020-Q1)	All bonds		Corporate bonds	
Green bond × *COVID*	0.0105	0.0162	0.0144	0.0259**
	(0.015)	(0.015)	(0.014)	(0.013)
Green bond	0.1438***	0.1070***	0.1092***	
	(0.021)	(0.020)	(0.021)	
COVID	-0.0050	0.0379		
	(0.008)	(0.033)		
Bond issue characteristics included	Yes	Yes	Yes	No
Fixed effects:				
Issuer	Yes	Yes	Yes	Yes
Issuer sector X country X time	No	No	Yes	Yes
Bond	No	No	No	Yes
Number of investors	6196	6042	6042	5965
Observations	119,510	114,450	114,450	111,417
R-squared	0.3714	0.3681	0.3743	0.5835
Adjusted R-squared	0.336	0.332	0.336	0.453

Outbreak period
- Concentration of corporate GBs increases w.r.t. to that of conventional bonds during market turmoil

- Holdings of GBs are more concentrated than those of conventional bonds in normal times

Rebound period
- No strong evidence of changes in concentration of green bond holdings during 2020-Q2

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Conclusions

- We investigate the resilience of green bonds (GBs) to the COVID-19 shock using data on institutional investors' bond holdings

- We do not find evidence of significant differences in sales of GBs vs conventional bonds in normal times

- However, during the COVID outbreak GBs experience consistently lower sales than conventional bonds, by mutual funds and insurers as well.

- Sustainability-oriented funds sell less GBs than their non-ESG peers in market turmoil

- GB ownership is more concentrated than that of conventional bonds, and, for corporate bonds, has increased during the COVID outbreak

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Thank you

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Matching: goodness of fit

Unmatched data

Panel A	Conventional Bond	Green Bond	Difference	t-stat
Yield at issuance	4.210 (2.466)	2.763 (1.901)	1.447 (0.166)	8.729
Maturity	12.657 (10.245)	10.634 (9.689)	2.023 (0.690)	2.933
Rating	7.353 (3.229)	6.999 (3.730)	0.355 (0.218)	1.628
Callable	0.679 (0.466)	0.430 (0.496)	0.249 (0.031)	7.922
Puttable	0.247 (0.430)	0.082 (0.274)	0.165 (0.029)	5.704

Matched data

Panel B	Conventional Bond	Green Bond	Difference	t-stat
Yield at issuance	2.843 (1.788)	2.614 (1.787)	0.230 (0.166)	1.385
Maturity	11.879 (11.197)	10.484 (8.965)	1.395 (0.981)	1.422
Rating	6.632 (3.548)	6.747 (3.818)	-0.115 (0.337)	-0.340
Callable	0.501 (0.501)	0.414 (0.494)	0.087 (0.048)	1.835
Puttable	0.034 (0.179)	0.047 (0.209)	-0.013 (0.018)	-0.740

The matching reduces the difference between treated and control group in their relevant characteristics (Yield at issuance, maturity, rating, callable puttable)

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Sales: top-rated ESG investors (MSCI)

Panel A: Outbreak period (2020-Q1)	All bonds	Corporate bonds		
Green bond × COVID ×ESG top-rated	-0.4795	-0.9134	-1.0025*	-1.2916**
	(0.413)	(0.587)	(0.595)	(0.506)
COVID × ESG top-rated	0.1810	0.5407	0.6427	0.7381
	(0.458)	(0.634)	(0.659)	(0.542)
Green bond × COVID	-0.0911***	-0.0818**	-0.0711**	-0.0629*
	(0.033)	(0.035)	(0.033)	(0.035)
Green bond × ESG top-rated	0.1192	0.4074**	0.4186**	
	(0.128)	(0.183)	(0.182)	
Green bond	-0.0046	0.0004	-0.0009	
	(0.026)	(0.027)	(0.027)	
COVID	0.2661***	0.4071***		
	(0.032)	(0.075)		
Bond outstanding amount	0.1298***	0.1587***	0.1539***	0.8372***
	(0.024)	(0.028)	(0.028)	(0.159)
Bond age	-0.0369***	-0.0379***	-0.0353**	-0.0181
	(0.013)	(0.013)	(0.014)	(0.020)
Downgraded	0.0301*	0.0361**	0.0350**	0.0194
	(0.016)	(0.016)	(0.017)	(0.016)
Bond holding by investor	0.0409***	0.0374***	0.0381***	-0.5821***
	(0.013)	(0.014)	(0.014)	(0.059)
Portfolio size	-0.2807***	-0.2906***	-0.3128***	-0.1192
	(0.070)	(0.075)	(0.079)	(0.076)
Bond issue characteristics included	Yes	Yes	Yes	No
Fixed effects:				
Issuer	Yes	Yes	Yes	Yes
Investor	Yes	Yes	Yes	No
Issuer sector X country X time	No	No	Yes	Yes
Investor country X time	No	No	Yes	Yes
Bond X Investor	No	No	No	Yes
Number of investors	3523	3409	3409	3352
Observations	66,653	62,476	62,476	60,415
R-squared	0.3674	0.3642	0.3714	0.5805
Adjusted R-squared	0.330	0.325	0.330	0.437

Outbreak period:
- evidence that AAA-rated ESG investors sell less of GBs only for the corporate bonds subsample

Rebound period (not shown):
- same as before

→ is this related to measurement /methodological issues with ESG ratings ?

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